Proceedings of the ANR #CreaMaker workshop: co-creativity, robotics and maker education.

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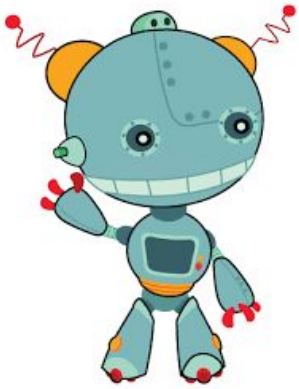
ANR **#CreaMaker** workshop: co-creativity, robotics and maker education

Proceedings



Workshop full program : **https://goo.gl/tVzztn**

April 1st and 2nd. International workshop
3 avril. Séminaire de recherche "Co-créativité et numérique"

Edited by Laura Cassone, Margarida Romero, Thierry Vieville, Cindy De Smet, Mbemba Ndiaye

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Addressing the global challenges through a (co)creative citizenship

We're living exciting but also challenging times at the worldwide level. From one side, there are environmental challenges that can compromise our future as humanity and the socio economic tensions generated in a context of mass consumption within a model of fossil and nuclear energy which endangers a sustainable development. From the other side, we have a growing number of citizen-based initiatives aiming to improve the society and the technological infrastructures making possible to cooperate at large scale and not only at a small-group level. Younger becomes empowered for their future. In their initiatives such #FridaysForFuture they are no longer (interactive) media consumers but move forward as creative activists to make older generations change the system in order to save the planet. At the same time, we have observed in the last years the emergence of a wide diversity of third places (makerspace, fablab, living lab...) aiming to empower communities to design and develop their own creative solutions. In this context, maker-based projects have the potential to integrate tinkering, programming and educational robotics to engage the learner in the development of creativity both in individual and collaborative contexts (Kamga, Romero, Komis, & Mirsili, 2016). In this context, the ANR #CreaMaker project aims to analyse the development of creativity in the context of team-based maker activities combining tinkering and digital fabrication (Barma, Romero, & Deslandes, 2017; Fleming, 2015). This first workshop of the ANR #CreaMaker project aims to raise the question on the concept, activities and assessment of creativity in the context of maker education and its different approaches : computational thinking (Class'Code, AIDE), collective innovation (Invent@UCA), game design (Creative Cultures), problem solving (CreaCube), child-robot interactions and sustainable development activities. Researchers from Canada, Brazil, Mexico, Germany, Italy and Spain will reunite with LINE researchers and the MSc SmartEdTech students in order to advance in how we can design, orchestrate and evaluate co-creativity in technology enhanced learning (TEL) contexts, and more specifically, in maker based education.

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Abstract

Creativity is often associated to representations of individual productions in the artistic fields. From a research perspective, creativity in learning contexts has mainly been evaluated focusing

on individual activities. We consider creativity as a level of cognitive engagement leading to create a valuable and novel process or solution for a given context or problem. In the context of creative activities, we consider co-creativity as the collaborative process in which learners are committed to develop a creative solution. To evaluate this process, we designed and developed a co-creativity scale (CoCreat), based on the literature review of the different creativity components carried out in collaborative learning contexts. Further on, we describe the development process of the CoCreat scale and each of its items. Next, we will present the results of the validation process of the CoCreat scale. The reliability and validity of this scale were verified on a sample of 421 French-speaking students. Factor analysis shows that theof the CoCreat scale consists confirm the structure based on of three factors with a satisfactory internal consistency. This scale aims to be an instrument that can analyze the creativity process in a collaborative learning setting in both secondary and post-secondary education.

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Co-creativity through Invent@UCA

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Abstract

INVENT@UCA is the Disrupt Campus program of the Université Cote d'Azur on digital innovation and entrepreneurship. The program, based on co-creation between diverse stakeholders on real life challenges, has the ambition to train students in soft skills (among others, creativity, collaboration, critical thinking and problem solving, learn to play in ambiguity). Skills that are poorly developed in classical academic training courses. Ambitious, the programme brings together numerous schools and partner institutions (centers of research, schools from business to engineering, universities and local institutions). It involves as well all students (from L1 to postdoctoral student) in the UCA ecosystem. Together it creates a melting pot which favours creativity, multi-field expertise and intergenerational exchanges. The creative collaboration between all the actors is indeed at the heart of the learning process. The situated learning approach (Stein 1998) place students in authentic learning situations where they are actively immersed in an activity while using problem-solving skills.

The program tackles digital transformation issues based on real business cases (DEMOLA) as well as societal challenges (OASIS) run with NGO, diverses associations or even citizens.

A focus on DEMOLA

The objective of DEMOLA is to develop the student's ability to apply and reflect on his/her knowledge as well as professional role in a multi-disciplinary team (consisting of 4--6 students from all faculties and different universities) while working on a real world innovation challenge together with a company representative (picture 1). The aim is that the student, via utilization of the methods of multi-disciplinary development processes and the inclusion of relevant theories, shall be able to analyze, develop, test and argue for solutions for the case. The students will work with different innovation methods (IDEO Idea generation, Bottom-up primary market segmentation, Persuasive Argumentation & Structured Thinking and Pitching) in order to qualify the case.

A focus on OASIS (Open source Actions for Societal ImpactS)

OASIS is a multi-disciplinary innovation project where students co-create solutions in order to solve societal challenges. OASIS teams work with real motivating challenges. Students are free to work for an existing challenge or create their own. The objective is –by open source actions– to reach social innovation with positive impact (on people, planet, profit). Learning expeditions are often necessary to understand the problem in the original context (picture 2 : Objective 80% recycling in Corsica).

In addition to a project based approach -so far around 30 projects and +250 participants, the programme offers hybrid and practical expert workshops, along with creative events (hackathon, jams, bootcamp).

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Developing (Co)creativity in maker education

Davidson

Dr. Ann-Louise Davidson holds the Concordia University Research Chair in Maker Culture. She is Associate Director of the Milieux Institute for Arts, Culture and Technology where she created #MilieuxMake, a university research makerspace. She is an Associate Professor of Education and she teaches in the Educational Technology graduate programs. Dr. Davidson's work focuses on maker culture, social innovation, inclusion and innovating with advanced pedagogical approaches and digital technologies. She created Education Makers, a research group that investigates the potential of maker education to prepare learners for the 21st century workforce. She has developed solid partnerships with schools, libraries, colleges, universities and NGOs to work together on youth motivation in stigmatized neighborhoods and marginalized communities through concrete maker activities. She also investigates how people from interdisciplinary fields develop identities as makers. She has expertise in action research methodologies that engage participants in collaborative data collection and meaning-making and hands-on studies in technology and innovation.

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Abstract

Creativity is deemed to be one of the most important skills of the 21st century. While we are unable to anticipate how big this revolution will be, we know it will involve "artificial intelligence, robotics, the internet of things, autonomous vehicles, 3D printing, nanotechnology, biotechnology, materials science, energy storage and quantum computing" (Schwab, 2016, p.1). Many have argued that human creativity, combined with empathy and critical thinking will allow the next-gen workforce to (co)work with the technological demands of the 4th industrial revolution (Engineers Canada, 2015; Wyonch, 2018). How we define creativity and co-creativity remains largely theoretical, which challenges how we engage with it in education. There is a scarcity of research that

allows educators to observe, measure and evaluate creativity. In a quest to unpack what complex concepts such as creativity and co-creativity are made of, I created a research group called “Education Makers” to develop workshop models and to document inclusive and intergenerational maker-led activities. In this talk, I will present the foundations of workshop models that allow multiple points of entry into maker education, including micro-events and large-scale events, highly curated events and open-design events. I will explain how educators can help develop (co)creativity through maker education. I will discuss what we can inject in the creative mix to encourage collective creativity, build creative confidence, creative agency, creative destruction and creative networking.

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Keynote: 21st Century Competencies in Maker Education

The maker revolution is here (Dougherty, 2012). Everyone can be a maker. Children are creating all sorts of STEAM projects. Teachers from all levels are being trained to integrate maker-based projects in their classrooms (Peppler . It is the Gold Rush of micro-prototyping technologies, robotics, 3D printing, laser cutting, electronic embroidery and embedded wearables. This is partly driven by the open-source electronic market emerging from Shenzhen, online DYI communities, data sharing over the Internet, but mostly by the worldwide movement driven by the 4th industrial revolution. The next workforce will be faced with the new demands of a ubiquitous, mobile and ambient Internet of connected objects fed by AI and machine learning

(Schwab, 2016). By 2025, the World Economic Forum (2015) predicts several technological tipping points, namely 10% of people wearing clothes connected to the internet, 1 trillion sensors also connected to the internet, the first robotic pharmacist, the first 3D printed car in production, and the first implantable mobile phone available commercially. This will bring unprecedented changes because they will arrive at a speed that will affect all our systems in all continents. They will force us to revise the nature of how we live, how we interact with each other and how we work. Maker education is part of the solution to prepare the next generation workforce because it confronts learners to programming languages, robotics, additive manufacturing, prototyping, the internet of things and the sensing environment. More than just knowledge about these topics, learners have to develop competencies that will prepare them for a complex and ever-changing world that even experts cannot yet imagine. In this talk, I will present the global context for maker education and an operationalized definition of how to develop competencies in this context. I will also present results of several studies on this topic (Davidson et. al., Davidson & Price). More specifically, I will discuss fundamental maker knowledge, attitudes, resources, and how to design activities to mobilize competencies to complete multi-faceted projects or solve complex problems.

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Child-robot interaction in unstructured settings

Charisi

Vicky Charisi is a Research Scientist at the Centre for Advanced Studies, JRC of the European Commission focusing on the impact of interactive and intelligent systems on human behaviour and development. Her focus of research lies on the role of embodied and social Artificial Intelligence (social robots) on children's learning and creative thinking. Vicky finished her PhD studies at the UCL, Institute of Education, London during which she investigated children's processes and interactions in computer-supported music-making identifying elements of collaborative creative thinking. She has worked as a post-doctoral researcher at the University of Twente, Human-Media Interaction group in the Netherlands with a focus on robot-assisted science learning and play. She regularly collaborates with robotics groups and with her research she contributes to the design and development of socially intelligent robots and to the evaluation of those systems in real-life scenarios. Vicky is an active member of the association Designing for Children's Rights which is supported by UNICEF, trying to address the emerging ethical considerations. Currently she serves as an appointed Chair at the IEEE Computational Intelligence Society for Cognitive and Developmental Systems TF for Human-Robot Interaction.

Abstract

Children in early years make sense of the unstructured environment through exploratory actions which gradually turn into meaningful deliberate behaviours. In this way, they first perceive existing patterns of their environment while they act upon it in meaningful for them and creative ways. During this process children make use of their intrinsic motivation and inherent curiosity and are likely to take risks, make mistakes and invent novel ideas usually within playful activities. Often this process takes place in collaborative settings where two or more children engage in self-directed collaborative play, which results in a distributed and shared cognitive and social engagement. Recently, interactive digital tools have been developed to support this process. However, these

screen-based tools often do not support the cognitive and social interaction with the physical world, which might have an impact on child's development. To address this limitation, a new paradigm has emerged which is based on embodied and social cognition, that of social robotic companions. We discuss our current research which focuses on the possible impact of socially aware robotic agents on child's cognitive and social engagement in various settings by providing examples from real life scenarios in formal and informal settings. We discuss various kinds of robot appearance (i.e. anthropomorphic features), behaviours and interventions and we review results from the field of child-robot interaction for typically developing and autistic children. Then, we identify emergent elements for discussion about the ways in which social robots can support child's learning and development as well as current methodological approaches that have been used for the evaluation of the impact on child's behaviour. Following this, we trigger discussion regarding the emerging ethical considerations from a child-centred perspective and we refer to the current debates on designing AI for children's rights. Finally, we review first steps on robot-assisted music-making activities as one of the current examples of social robots in highly creative contexts and we analyse robots' characteristics that facilitate children's collaborative music improvisation. Towards this end we take inspiration from current work on designing robots for collaborative music-making for adults and we identify special considerations in designing from children's creative process focusing on children's inherent need for exploration.

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Creative Cultures : how co-creativity is nurtured in the context of game design

Arnab

Prof Sylvester Arnab leads research and applied innovation at the Disruptive Media Learning Lab (DMLL) in association with the Centre for Post-Digital Cultures (CPC) and he seeks to explore and exploit opportunities for external collaborations informed by the infusion of innovative practices within the DMLL and applied across the University and beyond. As a Professor of Games Science, he forefronts the investigation into the application of playful and gameful approaches in teaching and learning practices at the University, which include game-based learning, serious games, gamification and playful learning. He co-founded the GameChangers – a Game Design Thinking initiative, which is currently being adopted and adapted in other countries, such as Malaysia. The circle of impact of current and previous work framed under the playful and gameful learning has expanded beyond the University Group into national and international domains and sectors. Sylvester has a large portfolio of funded projects and publications. To date, he has successfully won projects with a total value of £19 million since 2010 from funders including FP7, H2020, Erasmus+, NEWTON, AHRC and HEFCE. He is currently coordinating and leading the Beaconing project funded by the European Union's Horizon 2020 Research and Innovation programme, HEFCE funded Mobile GameChangers and NEWTON CreativeCulture project. He is also leading DMLL's contribution to the EU H2020 Crowd4Roads project and EU H2020 BOND project. Sylvester currently has over 90 academic publications, including one edited book- Serious Games for Healthcare

Abstract

Games, which are more readily blended with existing educational techniques and practices, are more likely to be accepted by teachers as useful resources. Hence, it is worth ensuring the design of game-based learning resources might support such blending, which can range from pragmatic considerations, such as how well an intended play session fits within a teaching schedule or homework arrangement, to pedagogical designs, which seek to address shortcomings in didactic instruction. To promote the sense of ownership and autonomy in order to break the barriers of adoption, not only that teachers should be part of the development process but they should also be empowered to create or co-create their own games - removing the barriers to the development of game-based learning resources. In the CreativeCulture

initiative - a spin-off project funded by the Newton Fund that is adapting the DMLL's GameChangers initative, teachers are empowered to create their own games towards engaging learners with educational contents. Game making can be used to foster the development of transversal skills, such as 21st century skills, where individuals can design and construct their own games, often working in teams, allowing them to engage in a task that involves - and at the same time fosters - collaboration, problem solving and creativity. Since the inception of the initiative in 2017, eighteen game-based learning resources have been developed, which have been tested in schools. Out of this experience, they have also co-produced a guideline for game-based learning to provide practical blueprints and templates for others to adapt. The initiative has also created a set of play cards based on the lessons learnt based on the teachers' experience, which provides useful prompts for informing educational game design. This paper will reflect on the lessons learnt and observations, which may provide insights on how we can remove the barriers to the process of innovating the way we teach and learn.

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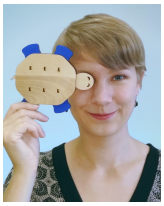
Computational Thinking with CS unplugged

Tsarava, Leifheit

Katerina Tsarava works as a research assistant at the Leibniz-Institut für Wissensmedien, Tübingen, Germany. She conducts her PhD research as a member of the junior research group *Neuro-cognitive Plasticity*. Her doctoral studies focus on the cognitive aspects of Computational Thinking and Game-based Learning. She studied Applied Informatics in the University of Macedonia (2013) and holds a Master's degree in ICT in Education from the Aristotle University of Thessaloniki (2016).



Luzia Leifheit is a PhD candidate at LEAD Graduate School. Since 2017, she has been working in computer science education research projects at the intersection of computer science, empirical education sciences, and cognitive psychology. Her current focus is on developing game-based, embodied, and conceptual methods for teaching computational thinking and evaluating them empirically using randomized controlled field trials.

Abstract

At the #CreaMaker workshop, we are presenting and demonstrating *Crabs & Turtles: A Series of Computational Adventures*, a board and card game series aimed at fostering computational thinking (CT) abilities through playful and cooperative learning.

What is computational thinking?

Being able to think computationally means understanding complex problems, formulating them precisely and then being able to solve them systematically. Such systematic problem solving typically requires skills in generalization, abstraction, identifying relevant variables and patterns, and deriving an algorithmic solution. CT is based on thinking processes such as abstraction, generalization, pattern recognition, conditional logic, algorithmic thinking, and partitioning a complex problem into smaller subproblems. These processes reflect cognitive processes that play a central role in programming. However, these processes are not domain-specific because they are not only applicable within programming. Consequently, teaching children to think computationally does not mean turning them into computer programmers, but helping them to develop their ability to understand complex problems and find strategies for their systematic solution. This is a valuable skill for creative problem solving: with CT, students learn there is never just one correct solution, but an indefinite number of approaches for creating strategies to solve a problem.

CT enables students to become makers and provides them with skills and strategies for bringing their own creations into being. By introducing CT in an unplugged way (that means without the use of technology), the focus is placed on conceptual foundations of computing rather than on specific technologies. Specific applications of computing technology keep evolving and changing

rapidly, but the conceptual foundations remain largely the same and are universally transferable to an infinite array of possible applications and creations.

Crabs & Turtles - a board game series for fostering computational thinking

To teach CT in a motivating and child-friendly way that fosters cooperative learning, we developed *Crabs & Turtles*, which is a series of three life-size educational games: 1. *The Treasure Hunt*, 2. *Patterns* and 3. *The Race*. *The Treasure Hunt* and *The Race* are board games, while *Patterns* is a card game. In 2018, *Crabs & Turtles* was awarded with the 1st prize in the 6th International Educational Games Competition at the 12th European Conference for Games Based Learning.

The core computational concepts used to develop simple algorithmic solutions are the basic concepts of sequences, loops, conditional branches, events, operators, data and variables. The *Crabs & Turtles* games introduce players to these basic computational concepts in a playful way. The games are aimed at children of primary school age or younger (8 to 12 years) who can already read, write and do simple math, but do not yet have any programming skills. However, *Crabs & Turtles* is also suitable for older students as well as for adults with little to no previous programming experience.

Crabs & Turtles was developed in a life-size game design to promote active participation in the game and thus increase players' motivation, but also to support the learning process through conceptual abstraction through embodied learning of foundational computational concepts. The games are deliberately designed to be independent of any specific programming environments or languages. *Crabs & Turtles* was created as board and card games rather than digital games to allow players to experience that applying CT is not limited to digital contexts, but can prove useful in all kinds of contexts (Tsarava et al., 2017). In cooperative as well as competitive scenarios, players co-creatively come up with their own strategies for winning the games.

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Co-creativity and computational thinking, the language issue

Viéville

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Abstract

In French, we make a distinction between human language (une langue) and formal language (un langage) not only related to computers (e.g., music score). Following the Gilles Dowek recent French essay "what can not be said must be written", we are going to analyse the differences between the former and the latter, because language being the vehicle of the thought, it is a major issue to understand the deep difference between computational thinking and other form of intellectual creation, at the language formulation level. Understanding these deep differences at both the syntactic and semantic levels is crucial to be able to properly teach both informatics and human language skills, and to see to which extents computational thinking initiation can offer a second chance to whom

has difficulties with other humanities. This ontological analysis will also offer us a new view about co-creativity, when considering co-creating using a language. For instance, human languages do not a-priori offer the capacity to create new atoms (e.g., new words) unless neologisms are allowed and manageable, while formal language do. On the contrary, formal languages, including music scores, have a bounded expressiveness, whereas human languages are almost not limited at this level. Such profound variations do not lead to the fact that the former or latter is better or worst regarding co-creativity, but that they are different, and we can not ignore such difference.

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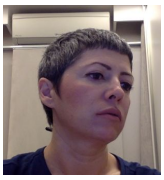
Developing Creativity and unplugged Computational Thinking by using COMICS

Nunes, Santos



Maria Augusta S. N. Nunes is an Associate Professor at Universidade Federal de Sergipe (UFS)/Universidade Federal do Estado do Rio de Janeiro (UNIRIO) in Brazil. As a researcher she created the project called Computer Science Popularization. This project use *Comics* in order to develop the Computational Thinking Pillars enabling students to be more qualified to solve their day-life problems as well as the problems found in the disciplines of STEAM. Her research also is directed to Affective Computing and Intellectual Property in Computer Science.

Cícero Gonçalves dos Santos is finishing his Computer Science Master's degree at Universidade Federal de Sergipe (UFS) in Brazil. As a Researcher he has developed many *Comics* for the project of Computer Science Popularization. His Master's thesis is towards to validate *Comics* as unplugged strategies in order to develop Computational Thinking in elementary and middle education.

Abstract

What is creativity? Brazilian society is considered to be quite creative. Maybe because of the political, social and economical Brazilian context. It's hard to survive considering the range of Brazilians' income. Then, Brazilians are usually searching and creating incredible newer strategies to make things actually happened in order to survive daily. In the educational field, it is not different. Teachers at elementary and middle school are always searching for new formulas in order to motivate students avoiding to lose them to criminal organizations, for instance. In peripheral schools, students can hardly structure their own thinking/reasoning process correctly. For instance make basic calculus, logic reasoning, or, even, interpret a newspaper's news could be very tough work. In Brazil, 48% of schools have no computational infrastructure for students. Considering this context, we proposed to use strategies to develop Computational Thinking creatively/co-creatively among students by using unplugged stuff, such as ludic activities and artifacts. We decided to use Comics as ludic artifacts to develop all 4 CT's pillars and also to help to popularize and demystify concepts and theories of Computer Science. Thus we created a Pedagogical Plan to be applied in the Portuguese and Mathematics course at 9th Grade of Middle school in a small city in Alagoas state in the northeast of Brazil. The experiments enabled the teacher to apply different concepts of Computer Science by using Comics in order to develop the 4 pillars of Computational Thinking in the Portuguese and Mathematics curricula. The

students were aged from 13 to 15 years old. We applied them two experiments for 9 weeks. Those two experiments were developed simultaneously during 9 meetings where we applied the

Computational Thinking Pedagogical Plan (CTPP) and then we compare the results (we got reliability Alfa de *Crombach* higher than 0,7 during the test and retest (before and after those experiments)). Both experiments of CTPP was conducted from September to October in 2018. We had two control groups: 50 students for the first experiment and 50 students for the second experiment. The results: For the first experiment of CTPP, we got 50 students (we applied the CTPP to everybody). After the application of pedagogical plan, they increased their grades: in Portuguese (+3,17) and in Mathematics (+3,214). For the second experiment, we got 50 students (we applied the CTPP for 25 students, the other 25 we did not apply the CTPP). After the application of pedagogical plan the 25 students who received CTPP instructions increased their grades: (+2,692) in Portuguese; (+2,848) in Mathematics (p-valor 0,000). For the 25 remained students who did not receive the CTPP instruction, their grades did not increase and remained the same. As a conclusion we perceived that the use of Comics in Portuguese and Mathematics curricula by means of CTPP promoted more creativity in students towards to solve their daily problems at school as well as it improved the students' ability for textual interpretation and logical reasoning. We also perceive that students revealed to be quite easily disturbed by any external event. Thus, as a future work, we wonder if we might decrease that by using Mindfulness technique as well as Roots of Empathy development.

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Coherence through co-creativity? Task-based tele-collaborations in binational teacher education

Schmider, Zaki

Christine Schmider is Maître de Conférences at the German Department and the Teacher Education Faculty of the University of Nice. She studied philosophy and comparative literature in Berlin and Paris (funded by the German "Studienstiftung des Dt. Volkes") and obtained her PhD from the Université Paris VIII after a DFG-funded graduate programme at the University of Freiburg and the University of Paris. She is member of the National ESPE network, of the National council of CAPES examiners, French head of the DFH-section on German-French teacher education, as well as responsible for the DFH/UFA teacher education program for secondary education UNS-PHF. Her research interests comprise comparative literature and philosophy, literature didactics, cultures of FL education as well as internationalization in teacher education.

Katja Zaki is Junior Professor (tenure track) for Romance Languages and their Didactics at the University of Education Freiburg and co-opted faculty member at the Faculty of Philology of the University of Freiburg. She holds a Masters degree in International Cultural Studies from the University of Passau, a degree for Upper Secondary Teacher Education from the University of Regensburg and a PhD in Romance Philology (socio-linguistics) from the University of Regensburg. She is responsible for the DFH/UFA-funded binational teacher education program Freiburg-Nice, member of the “media in education” group at the University of Education Freiburg, member of the international UniCollaboration-network for tele-collaborations in higher education and associated international researcher at the LINE/Nice. Her research interests include language contact and plurilingualism, the professionalization of foreign language teachers, internationalization of teacher education and CALL (computer assisted language learning).

Abstract

The digital transformation and migratory movements are among the phenomena that have been changing and shaping Europe’s classrooms in recent years. Learning and teaching environments are characterized by hybridity in many forms: by an increased cultural and linguistic heterogeneity on one hand, by a wide range of potential multimedia arrangements on the other, though these need not be seen independently from each other. In order to prepare future teachers for those dynamic challenges and possibilities, an awareness of difference – as well as of differentiation, adaptivity and collaboration, with or without using the potential of ICT – has become vital to any competence model in teacher education. Accordingly, against the background of changing challenges, reforms in educational policies have been spurred just as questions on educational effectiveness have risen. Two of the paradigms often stressed in this context are competence- and coherence orientation, related to the aim of educating teachers in an effective, “coherent” way, by integrating different domains of professional knowledge

(Baumert & Kunter, 2006; Krauss et al., 2004; Voss, Kunina-Habenicht, Hoehne, & Kunter, 2015) as well as by bridging gaps between different phases and agents of teacher education (Darling-Hammond, 2013). After sketching and contextualizing the need of these structural reforms in the German and French setting, our workshop aims at discussing a co-creative – i.e. collaborative, co-constructivist and also personalized – approaches to coherence-oriented teaching and learning arrangements as well as the ICT in this context.

The paradigm of Coherence in Teacher Education

With a stress on "coherence orientation and professionalization" in teacher education, the value of the acquisition of Pedagogical Knowledge (PK) and Pedagogical Knowledge (PCK) has risen in recent years, whereas the traditional transmission of Content Knowledge (CK) has been questioned and newly positioned in relation to other dimensions of professional competence. In this context, is not only essential to ask which function each component of professional knowledge has, but also how these components can be transmitted in integrative, profession-oriented and personalized learning arrangements (z. B. Cochran-Smith, Feiman-Nemser, McIntyre, & Demers, 2008; Zlatkin-Troitschanskaia, Beck, Sembill, Nickolaus, & Mulder, 2009) – as well as, particularly, which function and potential ICT may fulfil in this context. Educational systems and curricula certainly serve as an important frame for the individual, self-regulated and also co-constructive competence development of future teachers. Coherence, however, can only be attained, when teacher education students themselves perceive, build and co-construct the connections between different domains of professional knowledge and see the relevance for their profession and professionalisation.

Focus: Personalized coherence through co-creative approaches

In order to strengthen a personalized and dynamic approach of coherence orientation in teacher education, the use of ICT can serve as a medium, as an object and as a the focus. On the one hand, ICT in teacher education can serve as support structures and catalysts of coherent curricular structures, teaching modules and reflective learning tasks (e.g. via e-portfolios or e-tandems, for example). On

the other hand, ICT can also be the focus or the object of selected courses and projects in teacher education, be it in a subject-related or transversal way, or both.

Example: Task-based tele-collaborations in teacher education

Seen through the lense(s) of different educational cultures and approaches in Germany and France, our workshops seeks to explore and discuss the potentials and restrictions of ICT in coherent teacher education programmes by presenting and discussing the value of binational, task-based tele-collaborations. With the aim of creating coherent teacher education programs with innovative, interactive teaching and learning formats, in which students are encouraged to learn collaboratively in transnational communities of practice, we started a Design Based research Project on transnational, multilingual e-tandems in a task-based format. In this context, traditional formats of task-based (language) learning and teaching (Ellis 2013), were to be combined with new potentials of Web 3.0- environments (Becker et al. 2016; González-Lloret & Ortega 2016; Canto, Graaff & Jauregi 2016), in order to create course-based, content integrated formats of language learning and teaching through tele-collaborations with (individual and collaborative) e-tandem-projects. Within the workshop we will present course and task designs, discuss the impact on the competence development of students and first evaluation results.

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MakerEd for Historical thinking

Lille

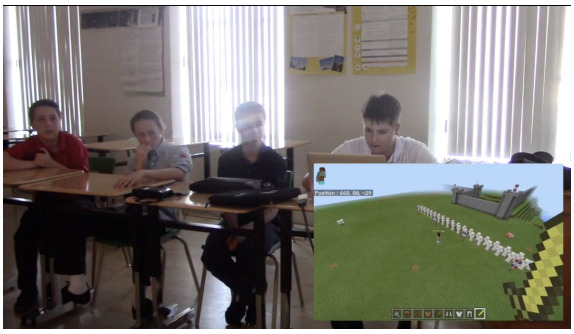
Benjamin Lille is an education consultant for the Quebec Federation of Independent Schools where he advises K-12 teachers on the integration of educational technology in the classroom. He has developed practical expertise on strategies integrating usages of digital tools to enhance students' learning experiences. Benjamin is also a master's student where he focuses on historical thinking, creativity, maker-based activities, computational thinking and 21st century competencies.

Abstract

Historical thinking, or historical reasoning, is considered to be an analytical and critical posture where historical sources are a breeding ground in producing historical interpretation to answer historical or historiographical questions (Yelle & Déry, 2017). The process of inquiring about the past is considered to be a creative investigation in which creativity is understood as the emergence of ideas that are original, valuable, purposeful and as a result of agency (Clark & Nye, 2017). However, historical thinking development through inquiry is a process with potential obstacles and students' resistance as historical inquiry can be cognitively demanding for novice learners. Novice secondary-level learners have trouble in taking responsibility for producing an interpretation of the past by articulating diverse historical sources because they see history as a neutral science (Gérin-Grataloup, Solonel, & Tutiaux-Guillon, 1994). High school student resistance in admitting the interpretative nature of the past is also an important tension in historical thinking development (Duquette, 2011). There is therefore a need to induce conceptual change for students to consider history as a creative endeavor in which interpretation is produced rather than only considering history as a transmission of one interpretation of the past that is often grounded in historical myths (Letourneau, Cousson, Daignault, & Daigle, 2015). To address this issue, we thought it pertinent to consider how maker-based activities, a growing movement in STEAM education, could help learners engage in a creative investigation about the past. Learning-by-making activities, a creative computing approach aimed at engaging the learners in the construction of digital and tangible artefacts

To

through the use of technology, has been argued to help develop 21st century competency such as creativity and critical thinking (Martin, 2015). In maker-based activities, participants are engaged in constructionist activities based on developing an idea and then designing and creating an external representation of that idea (Kafai & Resnick, 1996; Papert & Harel, 1991; Sheridan et al., 2014). Jefferson and Anderson (2017) highlight the potential of maker activities, both formal and informal, learning contexts to foster creativity. The maker movement culture based on sharing, autonomy, iteration, participation and support (Barma, Romero, & Deslandes, 2017; Cohen, Jones, Smith, & Calandra, 2016) could facilitate the emergence of creative processes and outcomes. Considering the potential of maker-based activities in developing creativity and critical thinking and need for student engagement to induce conceptual change (Limón, 2001), we co-created a collaborative maker-based pedagogical sequence in which students had to convey their interpretation of historical events through the usage of the sandbox video game *Minecraft*. In this sequence, students were asked to collaboratively answer an overarching historical question by constructing a digital representation using *Minecraft* of events set during the French and Indian war. Students were invited, in teams of four, to investigate primary and secondary sources to produce an original interpretation of their event and, on a broader scale, an interpretation addressing the overarching question.



Students were then invited to share their historical understanding through a collaborative interview in which they also had to answer questions on historiographical methodology. We created a survey adapted from Fu, Su, and Yu (2009) and from Koole, Dionne, McCoy and Epp (2017) to gather information on the usage of *Minecraft* and on the pedagogical sequence in general in order to use them as mirrors in a Change Lab session (Engeström, Virkkunen, Helle, Pihlaja, & Poikela, 1996). The early analysis of the Change Lab session revealed that students were, at first, generally more engaged in building with *Minecraft* than answering the overarching historical question although students progressively became more engaged in doing so. Moreover, the Change Lab session also shed a light on the potential tension between students' appreciation of having agency in the classroom and the effortful process that is inquiring about the past. Finally, students participating in the Change Lab session discussed the pertinence of inquiring about subjects on which they have high interest while having a few more teacher-led lectures for subjects that they are less familiar or less interested in.

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Co-creativity in maker-based education in Collège Beaubois (Montréal)

Girard

Marc-André Girard is the principal of Beaubois College in Pierrefonds, QC. He holds a B. Ed., an M.A. in History pedagogy, an M. Ed in School Administration and is currently a doctorate candidate in education. He focuses on implementing 21st century skills in teaching approaches as well as in the school's organisation. He studies change dynamics in educational environments as well as how leadership is the primary ingredient to sustain change in education and pedagogy.

Marc-André has been very involved in creating effective professional development, dealing specifically with the ideas around change in education. He has also authored many books on changes in education systems as well as on 21st century skills. He frequently writes in different medias. He can be reached through Twitter : @magirard.

Abstract

In september 2016, Collège Beaubois has implemented the first makerspace in a K12 school in Québec and most probably in Canada. The particularity of this implementation resides in the way it was developed and created but also in the way it is now part of the student's learning activities.

When we decided to create La Fabrique Beaubois back in september 2015, we chose to take a full year to plan its implementation and we wanted to include all stakeholders in the process : administration staff, teachers, parents, students and members of the community. We wanted to co-create it and base ourselves on the needs of its users, mainly students and teachers. This is why we made co-creation happen through a Living Lab and a design thinking process : innovation had to be fueled by the people who were to use it the most ! Also, we documented every step we made to make it accessible to the francophone community who would eventually join the maker culture : https://ecolebranchee.com/tag/makerspacebeaubois/

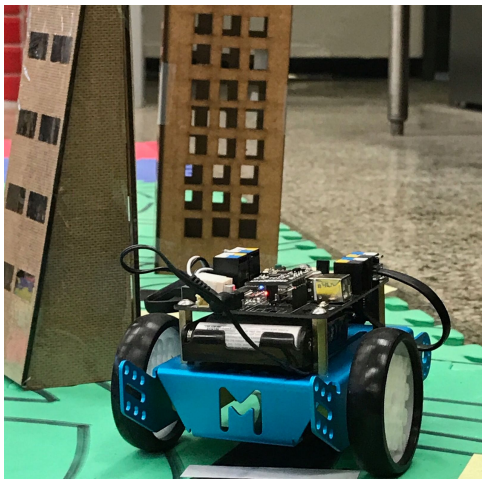
Everything had yet to be accomplished : interior design, human resources, material resources, etc. We had little or no expertise so we went out of our school to get it. We met with experts, existing fab labs in Montreal, Québec City and Ottawa as well as suppliers. We were fortunate enough to count on supplier to test-drive 3D printers, laser-cutters and other tools. We created

partnerships with stores and with businesses. For example, a parent of our school has a plastic and acrylic business. Twice a year or so, he gives us his scraps so we can use them in our laser cutter. We save money and he avoids throwing his scraps in the garbage.

Here's another example of co-creation, but this time, within class activities. Our secondary 1 (equivalent of grade 7) students must create a intelligent city model. We have five classes of 36 students. Each class chooses a tourist burrough of a major metropolis (Rome, Paris, New York, London, Montreal) and together, they must :

1. Draw the city plan up to scale;
2. Plan which building they must build up to scale using 3D solid modeling computer-aided design (CAD) and vector drawing;
3. Plan a route simulating public or tourist services (garbage picking, bus tour, etc.);
4. Program a mBot to ride this path and simulate the service;
5. Program actions from the robot : playing national anthem, contextual storytelling, lights flashing at a specific position, etc.
6. Simulate intelligent energy saving lighting;
7. Create a collective website with information on the metropolis and its famous tourist attractions or main buildings;
8. Plant different QR codes to specific locations;
9. Etc.

This has to be done by a large group so the teacher's role as a mediator is important. He must plan the co-creation process to insure collaboration pockets in a larger cooperation process. Therefore, all students alternate through all workstations in La Fabrique : programming, 3D conception, vector drawing, etc.



The final product is a functional smart city simulation that has been fully designed by students. It combines academic content extracted from math, computer sciences and geography curricula. We can develop 21st century skills in the three subject as well as teaching their content through active learning strategies.

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Literature review on creativity in education journals selected by the French National Board of Universities in education sciences

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	**Margarida Romero** is research director of the Laboratoire d'Innovation et Numérique pour l'Éducation (LINE), a research lab in the field of Technology Enhanced Learning (TEL). Full professor at Université Côte d'Azur (France) and associate professor at Université Laval (Canada). Her research is oriented towards the inclusive, humanistic and creative uses of technologies (co-design, game design and robotics) for the development of creativity, problem solving, collaboration and computational thinking. Margarida.Romero@Unice.fr / @margaridaromero / https://www.researchgate.net/profile/Margarida_ROMERO

Abstract

This research aims to review the literature on creativity in Education journals selected by the French National Board of Universities in education sciences (CNU 70). We limited our research to 67 journals covering scholarly education, which were subsequently scanned for articles on creativity. Only articles containing at least 5 times the word “creativity” and which were written in French were selected (n=48). A representative sample was obtained (n=24) and analysed based on the following criteria: a selection of keywords, definition of creativity proposed, content analysis, disciplinary fields, and type and level of education. Preliminary analysis shows that most articles were written from either 1) an epistemological point of view where creativity is considered

an aptitude to be developed by pre-service teachers and pupils; 2) a problem solving approach where creativity is linked to characteristics such as tolerance for ambiguity and risk taking; and mostly situated within artistic disciplinary fields, like dance, arts, written productions and drama. An analysis of the definitions proposed often refer to the definition by Sternberg and Lubart (1995) who describe creativity as the ability to produce work that is both novel (original) and appropriated (useful, adapted to a context). Other characteristics of creativity point to its transversal dimension and its role within the creation of teachers' professional identity.

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AI in Education: from books to robots

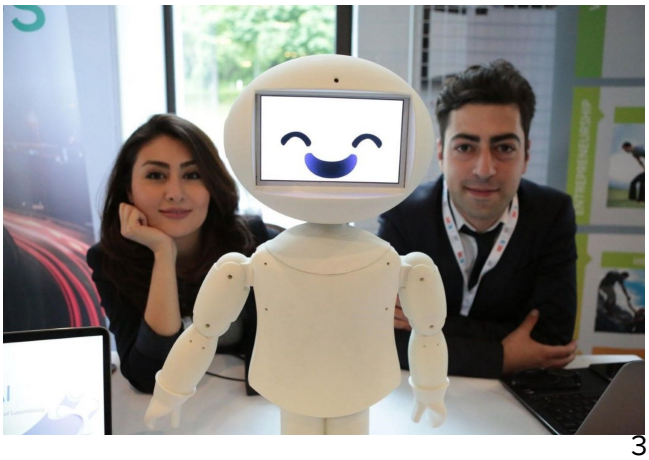
Vandewaetere

Mieke Vandewaetere has a background in cognitive psychology and data science. She started research in data-analysis of e-learning environments (educational data mining) to extract learner profiles and to support optimization of learning. She holds a PhD in instructional psychology and technology and did research in educational technology, personalized learning, adaptive instruction, game-based learning. Currently, she is head of the AI lab (Flanders, Belgium) and coordinates the AI research and AI education in Howest University College (Belgium). New research lines have been started up focusing on simulation-based education, educational technology, artificial intelligence, robotics, VR/AR and vital learning environments. She combines her job at Howest with her job as an independent consultant for training young adults in statistics, data analysis, thesis supervision.

Abstract

The term VUCA world is more relevant than ever (volatile, uncertain, complex and ambiguous) and both knowledge and people are subject to these rapid changes inherent in the nowadays technological revolution. This leads to the introduction of new technologies, production processes and business models. For this transformation to succeed, great value is put on education, learning, training & development, both in schools as in companies or organisations, for pupils, students and professionals as well. Nowadays' employers expect well-trained employees. Moreover, these employees must continue to develop in order to deal flexibly with the many changes that are forthcoming. For example, new categories of jobs will arise; existing jobs will (partially) be replaced. The World Economic Forum reports, for example, that almost 65% of the jobs that pupils in current primary education will do now do not yet exist.

Whereas learning has stayed the same for as long as we know; instruction and the effectiveness of information processing has changed a lot. No more Socratic dialogue; no more curricula that solely exist of ex cathedra education. Variety, differentiation, engagement and are key concepts in nowadays education. And again: great



expectations are put towards technology as a means to enrich instruction, to assist teachers, to enhance learning.

Computer technology has been used in education for over 30 years. Wedding computational intelligence and adaptive technologies with personalised learning involves major challenges, but provides also a great potential for personalised instruction and learning. There are nearly no limits anymore with respect to modeling and learning technologies. Increased computational power, together with more fine grained measurements of learning (not necessarily valid or reliable) and technologies from the domain of artificial intelligence, user modeling, and educational data mining provide highly sophisticated methods for the measurement, inference, and implementation of learner data in the development of personalised learning, by means of adaptive and/or intelligent systems.

Virtual tutors; virtual teachers; robot teachers; data-driven instruction; emotion detection in education; … A new wave of technologies is entering our society and again, there are high expectations towards their disruptive potential for education.

Combined with the existing technologies, the tremendous amount of (big) data that has become available has been demonstrated to unravel hidden layers in the learning processes and hidden clusters in learners. Data is now used to understand learning and provide better support for learning. Ranging from high-level figures, over academic analytics, educational data mining to learning analytics that provide actionable intelligence for learners and teachers, the field of education has become more data-driven than ever before.

In this 20 minute intervention we'll do a fast brainstorm of the ideal robot teacher for a random student/persona that you'll define. You'll think about concepts as robot knowledge, social robots, personalized robots, connected robots, coaching bots, peer robots. And most important: you'll draw your ideal (ro)bot teacher.

In addition, you'll think about the data that needs to be collected in order to prove actionable insights that support learners, teachers and hence, the learning process. You'll discuss prescriptive analytics, diagnostic analytics, predictive analytics and prescriptive analytics based on data gathered by your ideal (ro)bot teacher.

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Problem-solving in educational robotics

Kamga

Raoul Kamga has always had a keen interest in physics, chemistry, technology and their teaching. He has a master's degree in physics and a bachelor's degree in science teaching in high school. He is currently completing his doctorate in educational technology at Université Laval, where He his teaching the course on the pedagogical use of ICT for future preschool and elementary school teachers. HIs research focuses on the pedagogical integration of robots and the development of 21st century skills. Since November 2018, he has been a pedagogical advisor in the national service of the RÉCIT in the field of Mathematics, Science and Technology (MST).

Abstract

The development of citizens is a social concern. However, this development depends, among other things, on the skills of citizens and the environment in which they live or are expected to live. Nowadays, this environment is being modified by technological advances such as artificial intelligence, virtual reality technologies or robotic technologies, requiring citizens to develop a number of skills that can contribute to their development. According to Dindar (2018) and Eichmann, Goldhammer, Greiff, Pucite and Naumann (2019), complex problem solving is one of the fundamental skills that 21st century citizens must develop. Thus, it is relevant to involve the individual in solving complex problems. In our study, we engaged a team of future primary school teachers in a complex activity of educational robotics. The theory of expansive learning (Engeström, 1987, 2007; Engeström and Sannino, 2010) is the theoretical framework of our study. The objective of our research is to analyse the complex problem solving skills of future primary school teachers. The future primary school teachers who participated in our study were already a team before our study. Indeed, before the data collection, the members of this team had worked together for nine three-hour course sessions, one session per week. The educational robotics class session was divided into two parts. The first part presented problem solving and engaged participants in the implementation of introductory activities in educational robotics. The objective of these introductory activities to educational robotics was to prepare participants for the second part of the session. This second part of the session consisted of the educational robotics activity entitled "la grue intelligente", analysed in this study. The video

recording of the participants during the realization of the " la grue intelligente" was made, transcribed and analyzed. The analytical method is based on the cycle of expansive learning actions (Virkkunen and Newnham, 2013). This methodological approach is generally used to analyse the activities of a change laboratory (Engeström, Virkkunen, Helle, Pihlaja and Poikela, 1996; Sannino, 2016; Virkkunen and Newnham, 2013). As part of our research, we adopted this methodology to analyze the complex problems solving in an educational robotics activity. During the analysis, we first identified the different actions deployed by the participants during the educational robotics activity. In a second step, these actions were categorized based on the actions of expansive learning. The results of our analysis obtained suggest that expansive learning theory can be used as a framework for analyzing the resolution of complex problems. These results highlight that future primary school teachers have mobilized six of the seven actions in the expansive learning cycle. These are: questioning, analysis, modelling of new practices, examination of the new model, implementation of the new model and reflection on new practices. The analysis of the transition from one action to another within the expansive learning cycle highlights the difficulty participants have in moving from modeling a solution to examining and implementing it.

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Kids with Developmental Coordination Disorder playing with robotic cubes

Leroy

Anaïs Leroy is a PhD student in psychology, neuropsychology, at the Laboratoire de Psychologie Cliniques Cognitives et Sociales (LAPCOS) of the University of Nice Côte d'Azur (France). She studies semantic and emotional information processing during the categorisation of complex visual scenes in adults and children with or without learning disabilities. She is an assistant lecturer in the department of psychology at the Ecole Supérieure du Professorat et de l'Education (ESPE) and an assistant researcher at the Laboratoire d'Innovation et Numérique pour l'Education (LINE). She is also a psychomotor therapist working at the Reference Centre for Learning Disabilities at the paediatric hospital of Nice CHU-Lenval.

Abstract

About five percent of school-age children have a Developmental Coordination Disorder (DCD). This disorder is characterized by impaired motor abilities compared to children of the same age (APA, 2015) and by difficulties in the use of everyday tools at home, in leisure or at school. These difficulties affect the child's entire life and may cause psychosocial disorders such low self-esteem and peer rejection (Zwicker, Harris, Klassen 2013). However, despite this strong negative impact in the child daily life, few studies have analyzed the process underlying the impairment of DCD children in tools uses. In this project we want to compare the results of children with DCD in conventional neuropsychological tasks evaluating executive function, visual-construction and manual dexterity with their performance in performing a problem-solving task on unfamiliar modular robotic cubes through the CreaCube task (Romero, DeBlois, & Pavel, 2018). For comparing the performance of children with DCD to that of typically developing children on the CreaCube task, we will analysing their perseverance (i.e. number of attempts and of incorrect structures) and different time benchmarks: the time of manipulation, the time of detection of the technical characteristics of the cubes (presence of a switch, sensor, wheels), and the total time to complete the task. The aims of this study are : 1) to explore if the difficulties of DCD children in the use of familiar tools are also found with unfamiliar tools, 2) to analyse if the tool used deficit of DCD children are related to motor, executive or visuo-constructif impairment. These results may provide support for reflection on the care and schooling of children affected by this disorder.

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TRANSFORM - a bottom-up teacher development through constructive alignment and collaborative teacher learning

Timus

Dr Natalia Timuș is Senior Educational Adviser and researcher, Head of academic development scheme TRANSFORM at the Centre for Active Pedagogy of Université Côte d'Azur. Natalia is also Senior Fellow of Higher Education Academy, UK. She has extensive experience with innovative teaching and learning through teaching, training, research and project management. She was an e-learning academic expert at FASOS, Maastricht University (UM) in 2010-2011, promoting online and blended learning. Natalia was the project leader and manager of the inter-university EU TEMPUS project "Innovating Teaching and Learning of European Studies" (INOTLES), managed by MGSOG, UM in 2014-2017. Currently she is also partner coordinator for the Erasmus + Capacity building projects ELEVATE (Elevating the Internationationalization of Higher Education in Moldova) and MINERVA (Strengthening Research Management and Open Science Capacities of HEIs in Moldova and Armenia).
Natalia has published several book chapters and international articles on topics of innovative pedagogies and open science. Her latest publication is 'Innovating Teaching and Learning of European Studies: Mapping Existing Provisions and Pathways' (with V.Cebotari and A.Hosein), JCER 12(2), 2016. Currently her research interests focus on problem-based learning and student-centred learning, as well as (co-)creativity during the pedagogical transformation and innovation.

Abstract

Quality teaching and academic staff development designed to promote student learning outcomes represent salient issues within higher education. The Bologna process and the EU higher education policies have significantly increased their salience. However, teachers face multifaceted challenges regarding the adoption and transformation of their strategies based on student-centred learning. This paper analyses the case study of the design and the implementation of the TRANSFORM staff development scheme at the Université Côte d'Azur (UCA), France. Based on constructive alignment approach (Armellini et al 2009;

Biggs and Tang 2011; Salmon et al 2008) and collaborative learning, TRANSFORM represents a bottom-up pedagogical innovation at different levels: individual (teachers); course/programme teams, institutional. This initiative is part of the forward-looking vision of the UCA for its active pedagogy and blended learning. In cooperation with the University of Northampton, TRANSFORM also aims at establishing a professional recognition scheme for of UCA teachers by Higher Education Academy, UK. The findings of this paper provide useful insights into the design and implementation of teacher development that empowers individual teachers and builds the institutional capability in student-centred and blended learning.

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Ecologie, pensée complexe et résolution de problèmes: le cas des projets de co-création de potagers pédagogiques

Ganne

Virgile Ganne est actuellement étudiant de Master 2 en sciences de l'éducation à l'université de Bourgogne, en lien avec l'IREDU. Il consacre son mémoire au jardinage scolaire, sous la direction de Mme Géraldine Farges. Ses autres recherches portent sur les liens entre la pédagogie, l'environnement et la pensée complexe en contexte crise environnementale. En 2018-2019, il suit en parallèle une formation pour devenir professeur des écoles. Titulaire d'une licence de philosophie en 2013, il a réalisé des stages dans des écoles alternatives et des fermes biologiques entre 2014 et 2017, dans le cadre de son projet « Apprendre en Pédalant », une aventure à vélo entre la France et le Cambodge, dont le but de était de se former à l'agriculture et d'observer les différentes techniques pédagogiques et leurs différents fondements philosophiques. Habité par une volonté d'allier recherche théorique à pratique concrète, Virgile Ganne souhaite faire de ses futures classes des espaces co-créatifs et ancrés dans leur environnement proche (familles, école, associations, quartier, nature), dédiés au bien-être des élèves.

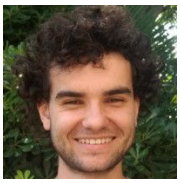
Abstract

Le jardinage scolaire est une pratique pédagogique créative ayant le potentiel d'introduire les élèves et la communauté scolaire dans son ensemble à une grande variété de connaissances et de compétences : environnement, biologie, alimentation, travaux manuels, mathématiques, arts plastiques, éthique, économie, etc. Les recherches menées sur ce thème au niveau international privilégient un angle d'approche centré sur l'alimentation et s'inscrivant dans une perspective sanitaire d'amélioration des régimes alimentaires, face à des problèmes sociétaux de surpoids et de carences croissants. Les chercheurs remarquent alors, dans leur majorité, que l'impact du jardinage scolaire sur l'alimentation des enfants est faible.

L'hypothèse selon laquelle une implication parentale accrue pourrait améliorer les effets des programmes de jardinage scolaire est régulièrement émise ; en effet, l'exposition des enfants à des pratiques contradictoires entre l'école et la maison, ou même entre la classe et la cantine, limite potentiellement l'efficacité des programmes de jardinage scolaire en matière d'amélioration des régimes. Cependant, aucun programme de jardinage incluant les parents n'a encore fait l'objet d'un travail de recherche, et aucune enquête portant sur la perception du jardinage scolaire par les parents ou sur le partenariat école-famille dans le cadre du jardinage scolaire n'a jusqu'à présent été menée. En nous appuyant sur une série d'enquêtes menées dans le département des Alpes-Maritimes auprès de directeurs d'écoles, institutrices, élèves et parents d'élèves, nous souhaitons explorer les enjeux que recouvrent pour chacun d'eux le jardinage scolaire et la perspective de la coéducation à ce sujet. Ce travail de recueil de données est pensé pour préparer l'expérimentation d'un programme de jardinage scolaire s'appuyant sur la coéducation. Nous défendrons ici une approche qualitative de type ethnographique, en considérant chaque école comme un cas relativement unique bénéficiant d'atouts particuliers liés à son ancrage géographique et aux personnes qui la font vivre. De ce point de vue, les modèles de coéducation, conceptualisés par Epstein et le courant des community schools, ainsi qu'une approche pédagogique basée sur la co-créativité, prennent tout leur sens pour penser la pratique scolaire du jardinage en vue d'une amélioration des régimes alimentaires. La population de notre enquête comprend plusieurs écoles primaires situées sur des territoires différents aux publics variés. Il ressort jusqu'à présent de notre travail que le jardinage scolaire fait consensus auprès des différents acteurs de la communauté scolaire, mais que divers obstacles empêchent souvent de pleinement le pratiquer. En conclusion, nous émettrons des hypothèses pour dépasser ces obstacles, à partir de pratiques de la coéducation et de la co-créativité.

Co-créativité en essaimage massif : le cas Idéaton.

Lefèvre, Sanabria-Z



Saint-Clair Lefèvre est le coordinateur pédagogique du MSc. SmartEdTech, co-créativité et outils numériques d'innovation pédagogique, qui est un programme international et à 90% en ligne. Étudiant en psychologie et en art-thérapie, il s'intéresse aux différents états altérés de la conscience induits par le son et à leurs applications / implications possibles dans l'apprentissage et le développement cognitif.

Pr. Jorge Sanabria-Z est enseignant-chercheur au sein du Système Virtuel de l'Université de Guadalajara (UDG). Ses axes de recherche ont pour objectif le développement des compétences du 21e siècle en utilisant une approche interdisciplinaire STEAM, grâce à la mise en place d'un réseau de laboratoires de fabrication numérique dans les lycées. Il a également mis au point une formation aux techniques techno-créatives pour les enseignants basée sur la Méthode d'Immersion Graduelle [Sanabria, 2015].

Abstract

IDEATON 2018 est une initiative du Festival de l'innovation Epicentro organisé par le Secrétariat de l'innovation, la science et la technologie de l'État de Jalisco, Mexique, avec l'Université de Guadalajara, institution à laquelle se sont associées l'Université Concordia (Montréal) et l'Université Côte d'Azur (Nice), pour mener à bien la recherche. L'objectif est de renforcer l'écosystème de l'entrepreneuriat à fort impact, en favorisant une culture de l'innovation par l'accès à la connaissance des outils numériques et la mise en réseau des talents, en phase avec les tendances mondiales en matière d'innovation et de technologie.

Pendant une semaine, 1000 étudiants de tous les établissements d'enseignement au niveau lycée publics et privés de l'État de Jalisco sont invités à participer à ce concours interinstitutionnel, qui vise à encourager les agents potentiels du changement, par le biais d'activités ludiques, dynamiques et créatives. Le but est de générer, avec une base scientifique et technologique, des solutions innovantes aux défis de la société à partir d'une activité de prototypage en utilisant un microcontrôleur et des composants électroniques (capteurs, moteurs, leds, etc). Les projets sont liés en particulier aux secteurs économiques stratégiques de l'État mexicain (par exemple, Santé, Électronique, Transportation et Construction), dans la lignée des objectifs du développement durable de l'ONU.

L'Ideaton comporte 4 modules -Épreuve de sélection, Camp d'alignement, Suivi des gagnants et Récompenses finales-. A la suite de la compétition, les lycéens ont accès pendant un an à une plateforme numérique et à différentes activités de formation afin qu'un suivi de chacun puisse être établi.

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Co-creativité dans la démarche créative du CurriqVideo

Faller, Heiser

***Christine Faller**, PRAG à l'ESPE de Nice, département d'histoire géographie. Docteure en histoire, associée à LINE – Université de Nice.*

***Laurent Heiser**. PRCE au département TICE de l'ESPE de Nice. Doctorant au laboratoire IMSIC Toulon sous la direction de Philippe Bonfils. Dans sa thèse, il s'intéresse à l'expérience des élèves dans le cadre de séances pédagogiques menées par des primo enseignants. Sa méthodologie est assise sur le paradigme de l'énaction. Associé à LINE, il alimente une réflexion autour d'un dispositif de formation à la techno créativité.*

Abstract

Le projet CurriQvidéo est un dispositif de formation qui permet aux étudiants de l'ESPE, pendant la formation initiale, de mener une enquête vidéo sur leur apprentissage d'une pédagogie techno créative (Romero, 2016). Ils doivent verbaliser sur des éléments d'objectivation qui leur ont permis de créer du sens autour de la mise en œuvre d'un scénario de résolution de problème et procéder à une collecte de données de traces subjectives de l'agir des élèves. Notre cadrage théorique s'appuie sur l'énaction (Rosch, Thompson, & Varela, 1993), à la fois pour permettre d'identifier les productions de sens des enseignants pendant leur apprentissage de la mise en œuvre didactique et pédagogique d'un cadre techno créatif et pour s'intéresser à l'apprentissage situé des élèves lorsque ces derniers créent du sens pour résoudre un problème, en particulier quand ce dernier fait références à l'enseignement moral et civique. La capsule vidéo montre que les enseignants en formation doivent questionner certaines représentations liées à leur rôle institutionnel, favoriser l'utilisation anthropocentrée (Albero, 2010)d'outils et de médias éducatifs tout au long de leur enquête pour favoriser l'engagement socio créatif des élèves. Nous montrons que le Currriqvidéo est une formation expérientielle à la techno créativité permettant aux enseignants de prendre progressivement conscience de la nécessité de maîtriser leur posture professionnelle pour favoriser une éducation de qualité en lien avec le développement de compétences du 21ème siècle.

La mise en place du dispositif doit permettre à l'enseignant du supérieur de mener ses étudiants néo professeurs sur la voie de l'appropriation des compétences didactiques nécessaires à des

enseignements de sciences humaines soutenus par des habiletés techniques en lien avec le numérique éducatif (Nadine Postiaux, Philippe Bouillard et Marc Romainville, 2010). Du point de vue des élèves, dans chaque curriQvidéo, une situation problématisée leur est proposée et elle traite de questions de société comme la lutte contre les discriminations, les aménagements urbains de demain, l'écocitoyenneté … Les élèves sont mis en situation de réfléchir collectivement à des solutions à apporter à ce questionnement. Ils débattent, confrontent leurs idées et arrêtent une décision démocratiquement.

Un corpus de plus de 200 curriQvidéos nous permet de rendre compte de l'« agir » des élèves, de la possible et nécessaire interdisciplinarité (Hertig, 2018) mais également l'expérimentation des valeurs (Falaize, 2018) pour une meilleure appropriation des notions et concepts. Enfin, la techno créativité (Romero, 2016) appréhendée à plusieurs échelles (professeur et élève), est rendue visible et permet d'accéder à l'expérience vécue des valeurs par les élèves et à la mise en œuvre de la compétence inscrite dans le référentiel de compétences de l'enseignant à savoir « faire comprendre et partager les valeurs de la République ».

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Activités d'apprentissage en éducation supérieure selon le modèle ICAP

Dordevic, Mirbel, Romero

Anja Dordevic *is a first year PhD fellow in the field of Education Sciences in the Laboratoire d'Innovation et Numérique pour l'Education (LINE). She conducts her thesis within the 10-year project called "L@UCA" that aims at transformation of undergraduate level studies at University of Côte d'Azur. Her research focuses on Competency-Based Education (CBE) in Higher Education context and in particular teaching methods within CBE approach. Anja has previously obtained a Master degree in Education Policy at University of Belgrade and Master degree in Education Technology at Centre de Recherche Interdisciplinaire.*

Isabelle Mirbel est Maître de conférences en informatique. Ses activités de recherche s'inscrivent dans les domaines de l'ingénierie des systèmes d'information, de l'ingénierie des méthodes et de l'ingénierie des besoins. De 2012 à 2018, elle a été vice-doyenne de la faculté des sciences en charge de l'insertion professionnelle et des relations avec les entreprises puis en charge de la pédagogie. Depuis deux ans, elle coordonne les activités de mise en place de l'approche par compétences au sein de l'UFR Sciences et des différentes composantes de l'Université de Nice Sophia Antipolis. Elle est également en charge du projet Sciences à la carte, en lien avec l'Université Numérique Thématique Unisciel, qui vise à développer les ressources numériques en ligne et plus précisément les tests d'auto-positionnement pour faciliter l'orientation des étudiants en licence.

Margarida Romero est directrice du Laboratoire d'Innovation et Numérique pour l'Education (LINE) de l'ESPE de Nice chez Université Côte d'Azur et professeure associée à l'Université Laval au Canada. Ses recherches sur la cocréation numérique visent le développement des compétences dites du 21e siècle, notamment la pensée informatique (projet Class'Code), la résolution de problèmes (projet #CréaCube), la créativité (projet ANR 2018 #CreaMaker) et la cocréation de jeux numériques en contextes intergénérationnels (ACT, Social Sciences and Humanities Research Council, Canada).
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Abstract

Au cours des dernières années, les universités européennes ont mis en place différentes initiatives dans le but de développer une pédagogie universitaire de qualité. Dans ce contexte, le projet L@UCA (NCU PIA3) vise à transformer la pédagogie universitaire afin d'améliorer la réussite des étudiants en licence. La thèse au sein du projet L@UCA a pour objectif d'étudier l'évolution des pratiques pédagogiques dans le contexte d'une approche par compétences (APC). Les pratiques pédagogiques des enseignants sont étudiées à partir de l'identification des activités d'apprentissage planifiées (syllabus) et de leur mise en oeuvre effective pendant les cours. L'étude sera menée, à la fois, du point de vue de l'enseignant et de l'étudiant. Dans ce but,

un premier travail a consisté à identifier et classifier les différentes activités d'apprentissage en pédagogie universitaire à partir du modèle ICAP (Chi, 2009; Chi & Wiley, 2014). ICAP est un cadre théorique qui vise à différencier les activités d'apprentissage selon le niveau d'engagement cognitif qu'elles exigent. Il consiste de quatre modalité - *Interactive* (qui concerne des activités avec le niveau d'engagement plus élevé, par exemple le débat entre pairs) puis *Constructive* (par exemple la prise de notes avec ses propre mots), ensuite Active (eg. soulignement du texte) et *Passive* qui se réfère aux activités qui exigent le moins d'engagement cognitif, comme par exemple écoute de cours sans faire rien d'autre).

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Construire pour écrire : la manipulation au service de la rédaction

Brunel, Dias-Chiaruttini

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Abstract

Cette communication s'appuie sur une recherche expérimentale et collaborative menée avec des enseignants du secondaire français. Il s'agit de faire produire aux élèves, répartis en groupe, un texte descriptif à partir d'une maquette réalisée au préalable qui représente un lieu du *Meilleur des mondes*, en lien avec l'œuvre lue en classe. Dans un second temps, le passage à l'écriture sur écran par des binômes permet aux élèves d'intégrer leur production dans le texte littéraire.

L'analyse porte sur les observations filmées réalisées par les enseignants selon un protocole précis et les productions des élèves. Nous situons notre réflexion en didactique du français et de la littérature dans les approches portant à la fois sur la description et la production sur écran afin de comprendre d'une part si la manipulation avant la production écrite est un élément facilitateur et mélioratif des textes descriptifs produits par les élèves et d'autre part nous cherchons à déterminer les effets de l'écriture collaborative sur écran sur la qualité des textes des élèves insérés dans le texte littéraire. Nous analysons ainsi des formes d'écriture créative et

collaborative articulées au texte littéraire en analysant l'impact des outils (maquette et écran) sur le processus créatif et la réception qui est ainsi réalisée du texte littéraire.

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Littératie numérique et co-créativité

Lacelle

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Abstract

Dans le cadre d'une recherche design sur la littératie médiatique multimodale appliquée en contexte numérique pour former les élèves à la recherche et à la création (Lacelle, Boutin, Martel, Richard, Lebrun, 2017-2020), nous avons cocréé des dispositifs didactiques adaptées aux ressources humaines, numériques, matérielles et thématiques des écoles secondaires participantes. Cette adaptation de l'équipe de recherche aux intentions disciplinaires en enseignement du français, aux idées de projets et aux ressources des milieux pour mobiliser les compétences en LMM@ a donné lieu à une redéfinition des rôles des acteurs et des objets dans l'élaboration de dispositifs didactiques. Dans le cadre de cette communication, nous allons documenter deux designs de cocréation de dispositifs didactiques pour en saisir les agencements propres à chaque projet afin d'en dégager quelques principes (théoriques et didactiques) émergeant de la démarche.

Nous allons d'abord présenter le protocole de notre recherche design, soit l'ensemble des principes et des approches méthodologiques destiné à étudier l'élaboration de dispositifs didactiques intégrant des ressources numériques dans des cadres réels complexes – qui comble l'écart entre théorie et pratique, et vise l'innovation. Ces méthodologies se basent sur une théorie du savoir voulant que le sens émerge et soit incarné dans la coparticipation des chercheurs, des praticiens et des participants dans des contextes bien définis (Anderson et

Shattuck, 2012, Basque, Contamines et Maina, 2010; Wang et Annafin, 2005), par exemple au cours de l'observation de pratiques co-construites, conséquence du design et de l'innovation, en classe à l'occasion d'un enseignement-apprentissage en cours d'évolution (Boutin et Lacelle, 2017).

Nous allons ensuite clarifier les fondements des savoirs introduits dans les dispositifs didactiques, notamment les notions de ressources et de milieux numériques (Bouchardon et Cailleau, 2018), de dispositif de cocréation (Richard, Théberge et Majeau 2017), de recherche documentaire numérique (Boubée et Tricot, 2011; Coiro, 2007), de production artistique numérique (Gervais et Saemmers, 2011) et de compétences en LMM@ (Lacelle, Boutin, Lebrun, 2017). La cocréation implique la participation collaborative de divers intervenants dans plusieurs ou toutes les étapes de création d'une activité, de sa conception à son évaluation. En contexte scolaire, elle peut aussi impliquer les élèves dans le choix d'un sujet, la mise en œuvre d'un projet, etc. Les ressources numériques sont les moyens offerts par les environnements technologiques (ex. : outils, supports numériques) pour comprendre et créer à l'aide de l'écrit, de l'image, de la gestuelle et du son.

Puis, nous allons décrire les designs de co-création et justifier la démarche adoptée par les équipes dans deux écoles de Montréal. Nous allons présenter les données recueillies sur les participants, leurs rôles, leur implication, les milieux, les ressources, les dispositifs didactiques et les productions des jeunes. Enfin, nous verrons comment la LMM entraîne un changement dans la dimension praxéologique de la didactique (Halté, 1992; Dauney et Reuter, 2008), car non seulement de nouveaux outils sont-ils désormais requis pour accéder à un savoir littératié, mais également ce savoir est-il désormais indissolublement lié à sa forme, à son « mode ».

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Conclusions

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After an intensive two-day program, involving scholars and practitioners from France, Germany, Greece, Italy, Spain, Senegal, Cameroon, Québec, Canada and Mexico, from diverse disciplines and epistemologies, we felt both excited and humbled. On one hand, we discussed creativity and co-creativity at length. On the other hand, we quickly realised that we all have a lot to learn and discover about co-creativity in robotics and maker education. Each individual only had one portion of the answer and these two days allowed us to collectively unpack at the phenomenon in all its complexities and intricacies.

We were reminded that the growth of scientific knowledge in the cognitive and learning sciences did not happen without conflict. This becomes evident when trying to define co-creation in robotics and maker education –we are careful not to offend colleagues from « other » paradigms and more empirical epistemologies. Regardless of how impossible some definitions might appear at the moment, if we want to move ahead we have no choice but to make a tentative to go further to unpack the terminology through experiences and guiding concepts and principles.

The #CreaMaker workshop: co-creativity, robotics and maker education, was an attempt to address the problem of relevance of what we teach for the 21st century global challenges we

face, both in terms of the future of work and for the emancipation of human beings. The pretext was to unpack several politically charged terminology, namely the dichotomy between maker education and the learn to code movement, and the values of grey between the two poles.

Our topics included presentations and workshops around constructivist, constructionist and socio constructivism theoretical underpinnings, communities of practice, computational thinking, unplugged activities, prototyping and innovation for start-ups, designing games for learning, board games to teach computational thinking, human language and formal language, coherence in teaching practices, empowering learners to co-construct meaning and invent through traditional disciplines, building makerspaces in schools, and learning with and from robots.

We highlighted several concerns around robotics and maker education, which is frequently presented as kits that offer episodic experiences to learners who wish to learn something concrete using code, hardware, microcontrollers, disruptive technologies and other materialities. We also highlighted concerns around merely learning to code which does not necessarily lead to computational thinking. Should we study micro-tasks and observe learners when solving contained problems, or should we study ill-defined tasks and open problems? After hours of exchanging on the debate, we concluded that they are both part of a system that has yet to be fully exploited.

We mutually agreed that this new mix of maker education, robotics, games and code has undisputed potential for 21st century education. It increases creativity, critical thinking, collaboration, collaborative problem-solving and computational thinking. Indeed, during maker-based activities, participants are usually seeking creative or innovative solutions, in a individually or collaboratively way, to solve problems in their community while also developing a deeper understanding on how electronic components work. This can also allow them to also develop an understanding on how connected and automated objects such as (...) work. Maker education can also help underserved and disadvantaged communities, that don't have the resources or revenues to buy material necessities, in creating artefacts with used or low-cost materials.

Some important distinctions need to be made. For starters, we have a need to go beyond learning to code, distinguish between structured learning experiences and lifelong learning or open learning. We need to continue mixing the disciplines and confront various epistemologies. We need to open channels between formal educational settings, such as schools, colleges and universities, informal settings, such as community organizations and public libraries. We need to

push it one step further and create links with start-ups and emerging markets that exploit the Internet of Things, artificial intelligence, emergent and disruptive technologies.

Looking ahead we need to ground theory into practice, to address the needs of learners that don't necessarily learn through memorization or cannot focus on textbook material for long periods of time, for those who ask "Stop talking about what this is and show me how to do it" or those who dare to ask the dreaded question: "Why are we learning this? What is the purpose?"

By forecasting the societal expectations of the future of work, we have certainly accomplished a lot in the past 4-5 years in schools. We built makerspaces and open creative spaces. We developed a positive relationship regarding co-creating with technologies. We are better informed about the use of tools such as 3D printers, laser cutters, electronic embroidery machines, power tools and even hand tools. We have demystified the interaction between electronic components such as microcontrollers, sensors, microcomputers. We have encouraged many teachers in accepting to learn alongside students when leading maker-based activities. We have accompanied youth in reusing objects from their environment to construct other objects to explore new and traditional materials, to transform material to serve specific purposes and to fix things that are broken or technologies they wish to revive.

All these accomplishments were done through mixing it up.